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ABSTRACT

This paper draws together current developments in computer-based education (CBE) with concepts from business process re-engineering. Topics discussed include: (1) re-engineering models, including the spectrum of approaches ranging from radical restructuring to evolutionary improvement, the stages of business process re-engineering (BPR), and information technology (IT) capability dependencies in the stages of business restructuring; (2) CBE evolution and revolution, including the impact of computer technology on teaching and learning, and application of the phases of BPR development to CBE; and (3) process redesign in the virtual university. (MES)

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Web Centric Education - a Challenge for Process Redesign

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Abstract: The fusion of computer and communications technology is giving rise to many novel developments in computer-based education and distance learning. Evolving web centric learning environments are challenging current modes of working in traditional universities. Over the last decade, higher education has been subjected to immense pressures for change. The massive increase in student numbers coupled with reduced levels of funding, lead many to the belief it is essential that new and innovative modes of teaching and learning are adopted. But how innovative are current uses of technology? Are present web centric environments not merely an electronic image of the traditional framework? As higher education finds itself moving towards a commercial market where it could be subject to commercial forces, it would seem reasonable to examine the impact of information technology on education using the same models adopted to evaluate its impact within commercial organisations. This paper draws together current developments in computer-based education with concepts from business process re-engineering.

1. Introduction

In the period from 400BC when Plato's Academy was established outside Athens to teach philosophy, mathematics and gymnastics, until the present day, the mode of the educational process has been remarkably stable. The idiom has essentially consisted of a small number of teachers delivering material to a larger number of students. This is true both for face-to-face learning and also for distance learning. As in Plato's time, there has been much more emphasis on the face-to-face approach while the numbers involved in the process – both teachers and students – have been strictly limited.

Distance learning approaches, and more recently computer based education (CBE) and computer aided learning (CAL) environments, have started to disturb the balance that has existed since Hellenist times. The introduction of IT and a business ethos to the educational process has given rise to pressures similar to those experienced in commerce, with a focus on customer needs and whether the organisation can efficiently meet these needs. Education is rapidly evolving from an opportunity that is provided mainly for an elite, to one that is available to a mass market and which is therefore prone to the forces generated by such an environment. Where, in the established pattern, commercial interest was limited mainly to the use of skills developed during the educational process, the future model of educational provision will involve extensive commercial activity in the production, delivery and marketing of material. Already there are a number of commercial companies offering framework products enabling "off the shelf solutions" for the construction and delivery of web based courses in any subject area. The commercialisation of education is underway and it is inevitable that entrepreneurs and customers will view it as any other commercial product. The commercial approach to education is emerging at a time when many business organisations are restructuring their operations to optimise use of IT. Such restructuring provides a clear pattern for changes within education.

2. Re-engineering - the models

Models for business change form a spectrum of approaches ranging from radical restructuring to evolutionary improvement. Their common purpose is that they aim to increase competitive edge by

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aligning business organisation with communications and information technology. A combination of radical and evolutionary paradigms is used to characterise business process restructuring [Venkatraman 1991]. This incorporates the ideas of business process re-engineering (BPR) [Hammer 1993] and identifies several stages in the evolution of IT based organisations. These stages operate at two separate levels. At the progressive level, the changes are of limited consequence to the organisation of a business whilst at the radical level, changes are incompatible with pre-existing business structures [Figure 1]. In general, an organisation will complete the sequential steps at the progressive level before proceeding to the independent changes at the radical level.

The initial stage in the restructuring process is characterised as localised exploitation of IT developments. Exploitation may impact business activities themselves or the administrative operations that support such activities. The use of IT may be tactical or strategic. Examples of such activities include the use of knowledge-based tools to support diagnosis of faults in electronic systems and the use of data mining techniques to focus marketing exercises. The significance of development at this level is that IT is exploited in discrete niches that provide business advantage. There is no coherence across an organisation in its approach to the use of IT.

The integration of IT activities across an organisation using a communications network represents the second stage of process restructuring. This stage is dependent on the existence of several computerised processes of the kind characterised by the localised exploitation stage. The benefits of this stage include greater integration of different functions within the business process and ready access by management to data describing the performance of the operation. Intranet development provides an organisation with a capability to operate at this level.

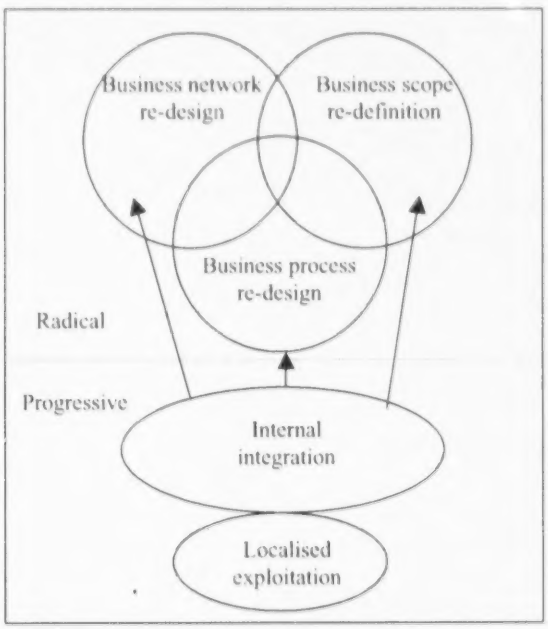

Figure 1: IT capability dependencies in the stages of business restructuring (after [Venkatraman 1991])

Within the radical stages of restructuring, business process re-design encapsulates the developments required in the organisation of commerce needed to provide major gains in the efficiency of business enterprises in response to IT investment. The technique involves fundamentally restructuring the ways in which a business operates to replace rigid product orientation.

The input to the re-engineering process is a system of business organisation that developed between the industrial revolution and the middle part of the 20th century. The system was focussed on functional decomposition and dealt well with limited product demand. The desired output from the re-engineering process is an improved level of product or service achieved at an expense that is a fraction of the costs before re-engineering. Asynchronous communication supported by IT provides the means for ensuring that activities that could only be accomplished by specialists in the functional decomposition paradigm can be accomplished by generalists in the re-engineered process or can be avoided altogether.

Development of Internet capabilities has done much to simplify the business network redesign stage of process restructuring. The use of such technology provides a basis on which co-operative processes involving discrete organisations can be constructed. Typical of this is the process of a manufacturer providing its suppliers with access to inventory levels with the understanding that the supplier would be responsible for delivering materials to re-supply inventory items at appropriate times. Both parties gain business advantage in such an arrangement. The supplier is able to optimise production and at the same time, the consumer is guaranteed that inventory is maintained at the most appropriate level.

The fifth level of business process re-engineering comprises developments in the types of business activities that an organisation conducts in response to perceived marketing opportunities. Examples may arise from business-critical applications that are developed by the organisation to solve specific problems and which are, in themselves, viable products. A typical example of such a change in focus is the development of MRP by General Motors. Initially conceived as an in-house system for supporting manufacturing of vehicles, this was later marketed as a product in its own right.

Despite the promises of BPR, it is difficult to show improvements in productivity as a consequence of increased investment in information technology infrastructure [Brynjolfsson, 1998]. Traditionally, major advances in productivity have coincided with the development of general-purpose technologies but significant changes in organisation have been required to maximise the benefit of these technologies. The replacement of steam engines by electric power was most successful where a single large steam engine was replaced by several smaller electric motors that provided power where it was required. It is not surprising that given the difficulty of demonstrating consistent productivity improvements generated by IT investment, most managers cite improvements in customer service and quality above cost savings as motivation for making investments in IT.

3. CBE – evolution and revolution

Computer technology has made a significant impact in many areas of teaching and learning. The introduction of desktop computers, word-processing packages and presentation preparation tools have improved greatly the quality of the material presented to students and used in lectures. The use of simple database packages and spreadsheets has improved and simplified record keeping at all levels within education. However, perhaps the most significant impact has come from the use of supportive learning mechanisms such as CAL and computer based training (CBT). These technologies make use of various forms of interactivity to engage the student in effective, and often novel, learning experiences.

Viewed from a business process re-engineering model all of these activities fall within the early or progressive stage of IT implementation, characterised by the local exploitation of technology to improve, in the main, the efficiency of the traditional legacy activities within the organisation.

The introduction of high-speed communication networks in the early eighties followed by the development of simplified and standardised access and presentation software in the form of web browsers, in the nineties, has enabled the easy sharing of information within organisations (via Intranets) and externally (via the Internet). Arguably, educational institutions have grasped this phase of IT development more than industry and commerce. Academics were quick to see the potential of the World Wide Web and web technology as a means of retrieving and sharing information. Intranets and the Internet now form the IT platforms in many academic institutions for the integration of many teaching and auxiliary activities: access to publicity material, course records and regulations, minutes of committees, course notes, on-line assessments and CAL animated simulations. The list is extensive

and growing. Nearly all legacy activities offered by the faculty, or the institution as a whole, can be made available within and outside the organisation, using web-based technology.

At this stage of IT adoption, development has gone beyond individual activities exploiting their isolated IT applications and the integration of the institution's needs is now being handled through the shared IT platform. The fundamental processes however, remain basically unchanged: the university continues to carry out its basic activities - registration, lectures, assessment etc., as before but has made full use of the IT infrastructure. Completion of this stage marks the end of the progressive phase of IT adoption; the organisation has evolved, and through incremental change has adopted the use of the IT platform across its various activities.

The next phase of BPR development is characterised by a radical change in the way an organisation operates. In this phase, new technology enables a completely fresh approach to achieving the organisation's goals and does not simply provide support for the existing legacy operations. Business process redesign for education would involve not merely an improvement of existing practices, such as better CAL software or better multimedia presentations at lectures, but also, and more fundamentally, a reappraisal of the existing practice and a search for new and more efficient methods of achieving the organisation's goals [Mandviwalla 1998].

One area where teaching and learning practices are being re-examined is the implementation of distance learning courses delivered making use of technology based on the Internet, i.e. the Virtual University. Within this structure the technology is fully exploited to provide an environment where students can perform all their work remotely - accessing lectures from the home, tutorial discussions through news groups or on-line conferencing mechanisms, learning in a simulated environment, accessing a wide variety of information over the Internet. In the virtual university certain kinds of behaviour are encouraged and enabled. For example it is easy to communicate on a wide front, to search libraries and vast quantities of information, and to copy material. These capabilities have much to offer promoting student centred activity. However, they also have the potential to severely threaten aspects of quality as viewed from the conventional academic framework [Ferguson, McGettrick, and Smeed 1999].

While on the surface the virtual university concept might appear radical and a candidate for stage three in the BPR framework, close investigation does not show a fundamental shift from the basic legacy teaching and learning processes that are associated with traditional universities. The virtual lecture theatre, virtual coffee shop, assessment engines etc., are all parodies of processes within the traditional system.

4. Process redesign

Currently, traditional university learning is teacher centred. Within a virtual university the focus will shift from the teacher to the student. Inevitably, new approaches are required to produce materials that invite sustained study and examination. The role of the teacher will change to deal with the functions of evaluation and monitoring of distant learners as well as the author of material suitable for independent study. Incidentally, changes in the mechanisms of teaching delivery cast requirements for new techniques that ensure originality of work and protect against plagiarism and misuse of copyright.

Opportunities may develop for activities that have proven difficult to implement in traditional curriculum design. For example, many curricula seek to highlight common themes or lateral links between traditional, but separately taught topics or courses. It may be possible to ensure that these important keystones are highlighted to the student across what may appear to be totally disparate topics.

A number of emerging techniques offer radical enhancement to Web-based teaching. In particular, the need for dynamic control, annotation and interlinking of content can be addressed through recent developments. A key to all such ventures is a move away from manual organisational techniques toward automated management. The limited effectiveness of conventional Web-search and association facilities will soon be superseded by powerful context-sensitive trawling and data-mining approaches

(cf. [Brin and Page 1998] and [Chakrabarti et al 1999]). Localised control of dynamic annotation may be secured through use of a Web-based software intermediary (e.g., as proposed in [Weir and Lepouras 1998]). Finally, the existence of fellow learners in similar but remote contexts promises the prospect of new supportive and co-operative learning opportunities [Kumar et al 1998].

Whatever the impact of such developments, there is a need to re-examine the basic processes on which current education is based and to be prepared to re-engineer the system to make maximum advantage of the opportunities provided by new technology.

5. Conclusion

The development of a mass market in education is leading to the commercialisation of the process and a decreasing emphasis on face-to-face teaching methods in favour of distance learning and especially distance learning supported by CBE.

The parallels between business process re-engineering and IT investment in industry and the development of computer based education suggest that the fundamental benefit which can be sought by the introduction of technology is improvements in product quality and customer service. In view of the significant investment required to produce good quality educational material, it is important that there is some form of measurement of the improvement that such systems generate. Without this quantification of benefit, it will be increasingly difficult to justify continuing investment in CBE development

There is a lack of overwhelming evidence that business process re-engineering consistently produces commercial benefits although there are isolated cases where this is so. While re-engineering in business has been progressing for almost a decade, education is only now being drawn into the process. Both business and education face major challenges in attempting to capitalise on the opportunities presented by IT in re-organisation.

References

Brin, S. & Page, L. (1999). Dynamic data mining: exploring large rule spaces by sampling, Paper No. 261, Department of Computer Science, Stanford University.

Brynjolfsson, E. & Hitt, L.M. (1998). Beyond the productivity paradox, *Communications of the ACM* vol.41, Part 8, pp. 56-62.

Chakrabarti, S., Dom, B.E., Gibson, D., Kleinberg, J., Kumar, R., Raghavan, P., Rajagopalan, S. & Tomkins, A. (1999). Mining the link structure of the World Wide Web, *IEEE* Computer.

Ferguson, J.D., McGettrick, A.D. & Smeed, D.N. (1999). Quality Issues in a Virtual University, in *Proceedings of CATE'99*.

Kumar, R., Raghavan, P., Rajagopalan, S. & Tomkins, A. (1999). Trawling the web for emerging cyber-communities, *8th WWW conference*, Toronto, Canada.

Hammer, M. & Champy, J. (1993). *Reengineering the corporation: a manifesto for business revolution* (London: Nicholas Brealey Publishing).

Mandviwalla, M. & Hovav, A. (1998). Adapting business process redesign concepts to learning processes, *Business Process Management Journal*, Vol.4, No.3, pp186-203.

Venkatraman, N. (1991). IT-induced business reconfiguration, in *The corporation of the 1990's*, ed M. S. Scott Morton, pp. 122-158. New York, NY: Oxford University Press.

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